hep-ph/9310316

ERRATUM TO: Power corrections $1/Q^2$ to parton sum rules for deep inelastic scattering from polarized targets

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published in Physics Letters B242 (1990) 245

Abstract:

We clarify conflicting results in the literature on coefficient functions in front of higher twist operators contributing to the parton sum rules for deep inelastic scattering from polarized targets. The necessary corrections do not affect our calculations of matrix elements, but change final estimates of the $\sim 1/Q^2$ contributions to Bjorken and Ellis–Jaffe sum rules.

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Recently, Ji and Unrau [1] have pointed out that coefficients in front of higher twist contributions to the sum rules for polarized deep inelastic scattering given in [2] contain errors. We have checked the calculation of [2], and indeed have found that the factors 8/3 in front of the kinematical corrections given in eq.(51) of [2] must be replaced by 4/3, in agreement with [1]. In addition, we have found an overall sign error in the expressions for the moments of $g_2(x)$ given in eq.(47) of [2]. The statement of [1] about the sign error in the coefficient of the twist 4 operator is not correct. The difference in sign between [2] and [1] is due to different conventions for the γ_5-matrix and the $\epsilon_{\alpha\beta\mu\nu}$-tensor. The conventions used in [2, 3] are taken from [4]. We thank A. Vainshtein for the correspondence on this point, and understand that authors of [2] agree to the changes specified above.

The calculations of power corrections in [3] have used the expressions given in [2], and must be corrected, respectively.

- Throughout the paper, the coefficients in front of the kinematical power corrections $\sim m_N^2$ acquire an additional factor 1/2.

- In eq.(4) the sign of the second term (twist three) should be reversed. This induces the sign change in front of the second terms in eq.(16), eq.(17) and in the non-numbered equation after eq.(5), which becomes

$$-\frac{8}{9Q^2}\left(\langle\langle U\rangle\rangle - \frac{1}{4}m_N^2\langle\langle V\rangle\rangle\right) = -\frac{\langle\langle O\rangle\rangle}{Q^2}$$

- We thank D. Roberts for pointing to us an error in the stability plot for $\langle\langle U\rangle\rangle$ shown in Fig.2, which is due to the error in the computer program. The correct value for the singlet matrix element $\langle\langle U\rangle\rangle \simeq 0.05\,GeV^2$ is given in the preliminary publication of this paper [5].

- We take this opportunity to correct misprints. The factor m_N^2 should be added on the r.h.s. of eq.(7). In the sum rules in eq.(11) the generic operator O stands for either U or $m_N^2 V$. The second formula in (16) gives the second moment of g_2^{p-n}.

Our final values for the particular combination of twist 4 and twist 3 matrix elements defined above are

$$\begin{aligned} \langle\langle O^{NS}\rangle\rangle &= 0.09 \pm 0.06\,GeV^2, \qquad \langle\langle O^{S}\rangle\rangle = 0.09 \pm 0.06\,GeV^2. \\ \langle\langle O^{p}\rangle\rangle &= 0.09 \pm 0.06\,GeV^2, \qquad \langle\langle O^{n}\rangle\rangle = 0.0 \pm 0.03\,GeV^2. \end{aligned}$$

The final eqs.(14),(15) should read

$$\int dx\, g_1^{p-n}(x,Q^2) = \frac{1}{6}\left\{g_A[1-\frac{\alpha_s(Q^2)}{\pi}] - \frac{(0.09\pm 0.06)GeV^2}{Q^2}\right\} + \frac{2}{9}\frac{m_N^2}{Q^2}\int dx\, x^2 g_1^{p-n}(x), \tag{14}$$

$$\int dx\, g_1^{p+n}(x,Q^2) = \frac{5}{18}\left\{g_A^S[1-\frac{\alpha_s(Q^2)}{\pi}] - \frac{(0.09\pm 0.06)GeV^2}{Q^2}\right\} + \frac{2}{9}\frac{m_N^2}{Q^2}\int dx\, x^2 g_1^{p+n}(x). \tag{15}$$

We gratefully acknowledge the correspondence with X. Ji, M. Karliner, D. Roberts and A. Vainshtein, whose interest initiated this Erratum.

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